

(12) UK Patent Application (19) GB (11) 2 193 000 (13) A  
 (43) Application published 27 Jan 1988

(21) Application No 8717284	(51) INT CL <sup>4</sup> G01G 19/413
(22) Date of filing 22 Jul 1987	(52) Domestic classification (Edition J): G1W L A4L 133 AAK
(30) Priority data (31) 889952	(32) 24 Jul 1986 (33) US
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(54) A self-checkout system

(57) An article checkout system incorporates two weighing scales 16,20 aside a checkout counter 10 having a UPC scanner 12. As an article is taken from the shopping cart on the in-scanner scale, the system makes an immediate determination of the decrement weight associated with such article removal. Upon scanning the article UPC and obtaining its weight from computer store 24, the system compares the decrement weight with the computer-provided weight. Should there be any discrepancy between the compared weights, it is detected by the system at the close of the scan and prior even to movement of the article to the shopping cart on the out-scanner scale, activates a monitor unit 44 to alert staff or activate monitor 14 at the checkout counter. A video recording is thus made of the events following close of scan and entry of the article into the shopping cart on the out-scanner scale. A second level comparison is also made between the combined weight in scale 16 and the weight of an article on the counter as determined by its UPC code and the weight in the out scale 20. Discrepancies activate a further alarm.

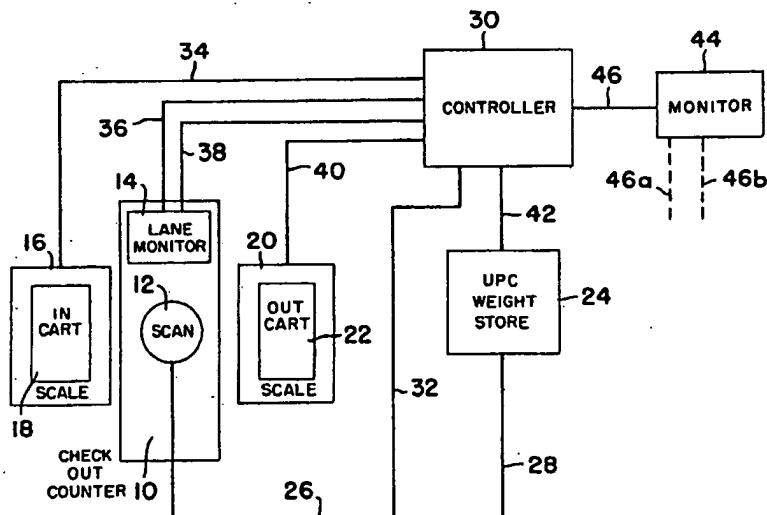


FIG. 1

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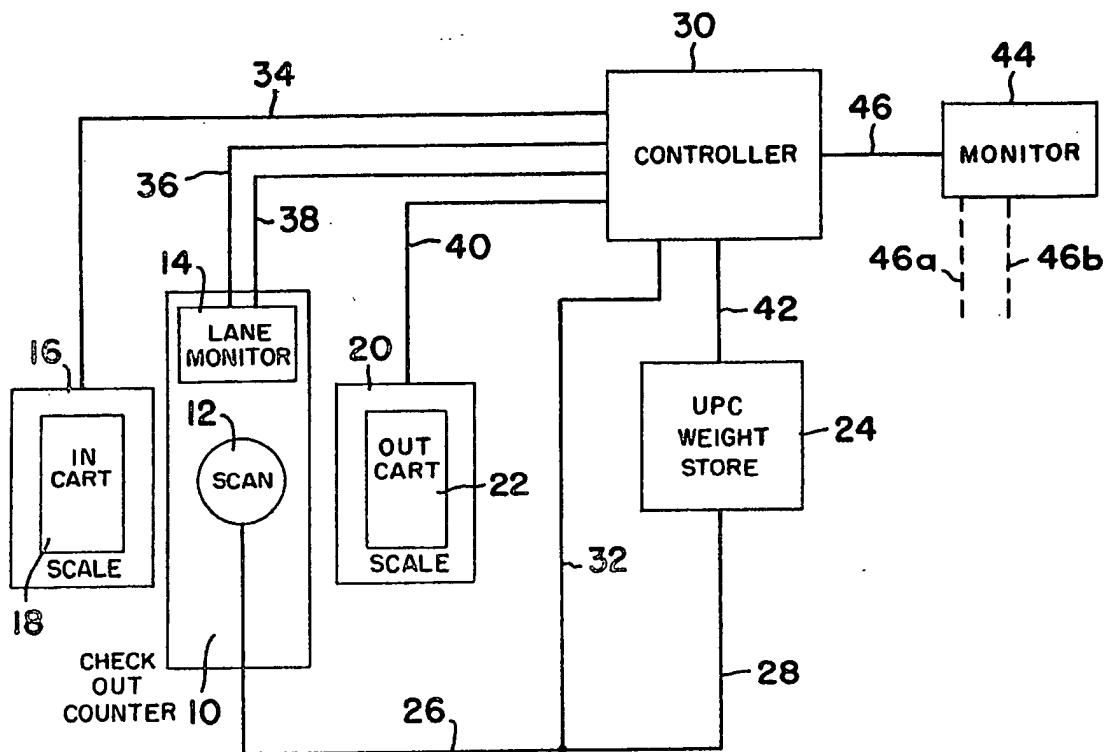


FIG. 1

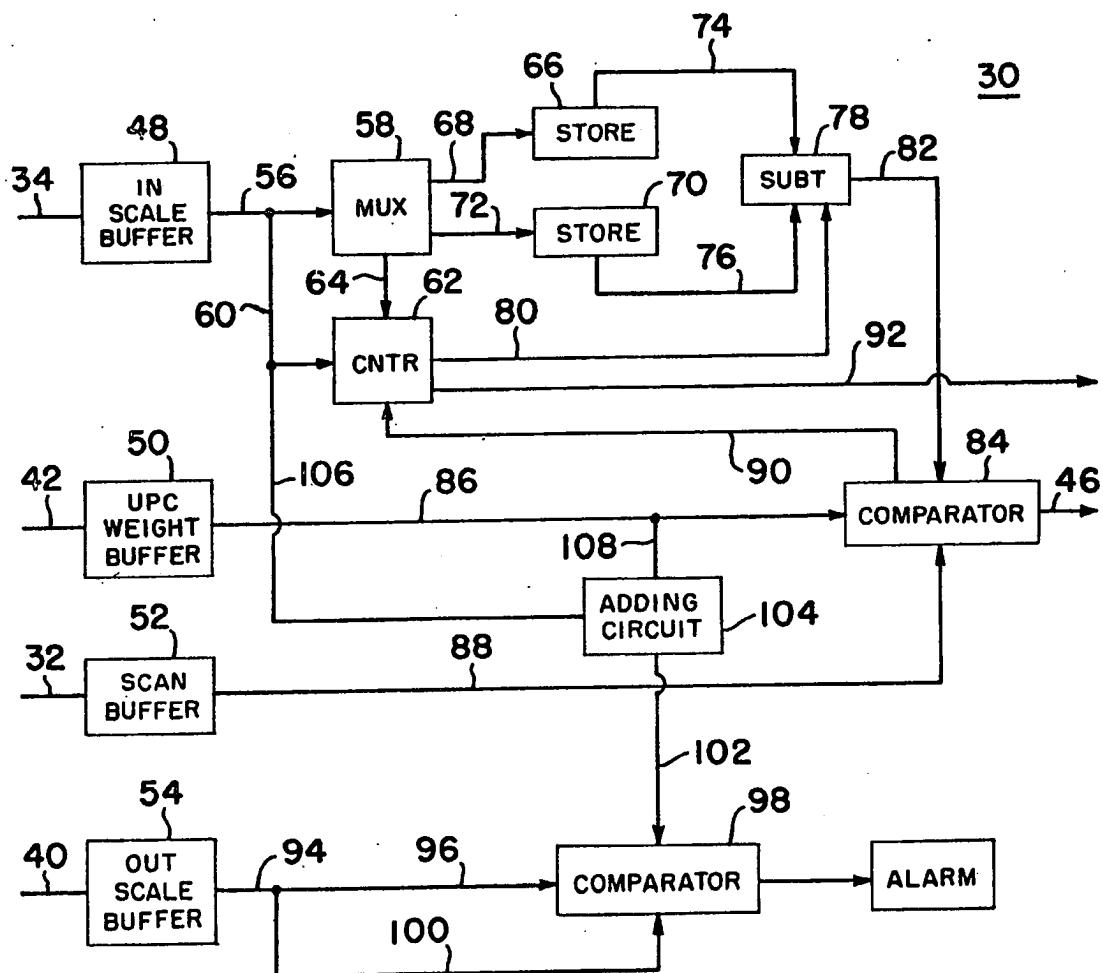


FIG. 2

## SPECIFICATION

## A self-checkout system

5 The present invention relates generally to product checkout and pertains more particularly to systems for generally operator-unattended checkout of products in supermarkets and like facilities.

10 Operator-unattended product checkout in supermarkets has evident advantages in lessening overhead employee costs and, to the extent that such relatively automated checkout can be made expeditious, in conserving the time a customer will spend in the course of checkout.

The art has looked over the past decades to improved systems and methods for lessening the need for employee involvement in product checkout. A principal endeavour in this connection has been to provide a scheme which is operative, despite human frailties of fraud, i.e., cheating the system in place. As is evident from the state of the art numerous efforts of an anti-fraud or anti-cheat character have previously been proposed.

A primary direction followed in the prior art is that of measuring a physical characteristic of articles selected for purchase, typically the individual or collective weight thereof, and comparing such measured characteristic with an expected standard therefore. In one prior art teaching, weight is measured collectively of articles selected for purchase after individual processing thereof with article identification. In a more modern prior art implementation, product identification is provided by sensible codes thereon. A computer stores provides indication of article weight responsively to the sensing of the code thereon. Comparison is made of actual article measured weight in the course of conveyor movement thereof with the weight provided by the computer store. If the comparison does not yield a positive result, conveyor movement is reversed and the conveyorized product is returned to the customer.

In other systems which we have previously proposed, various provisions of security nature are implemented, for example, the providing of a security tunnel into which articles are placed for measurement of article characteristics for comparative purpose. Beyond article weight observance and comparison, such commonly-owned systems look to shape identification and redundant sensing of article code within the security tunnel. In such systems, shape observance may be effected by the light curtain covering the entry to the security tunnel. Information to be stored in respect of article identification code, weight and shape may indeed be derived in the commonly-owned systems from the scanning unit, weight scale and shape sensing devices.

65 In a further prior art approach, implemented

commercially in the Reams stores in the state of Utah but not known to have been disclosed in a Patent Specification, a checkout area is provided with a counter which has in-floor weighing scales on each of its opposite sides. The customer moves a shopping cart containing articles selected for purchase onto one of the scales, which will be termed the in-scanner scale. An empty shopping cart is placed 70 on the other scale, which will be termed the out-scanner scale. Between the weighing scales, the counter includes a UPC (universal product code) scanner. The customer moves articles individually from the shopping cart on 75 the in-scanner scale, over the scanner and into the shopping cart on the out-scanner. It is believed that this system operates by obtaining the scanned article weight from a UPC-weight correlation table in a computer and using this computer weight to determine 80 whether, for a given article scanned and moved into the cart on the out-scanner scale, one scale shows a decrement in collective article weight and the other an increment in collective article weight corresponding to the computer weight.

While the systems and methods disclosed in our first specification are deemed to be quite effective in addressing the aforementioned human fraud frailties, they are relatively complex and costly, and may be inapplicable for reasons of economy in certain installations. The plural weighing scale approach is seen as providing a simpler and less costly method for 95 use in such facilities for generally operator-unattended checkout or articles selected for purchase in supermarkets and like facilities. However, there is a need for a simpler and less costly method to provide enhanced protection for store managers and parent organizations.

Accordingly, it is an object of the present invention to provide an improved and generally simpler operator-unattended checkout system and method.

It is a further object of the invention to effect selective and effective anti-fraud monitoring of plural weighing scale type article checkout systems.

115 With a view to achieving one or both of the above objects, the invention provides an article checkout system incorporating plural weighing scales aside a checkout counter having a UPC scanner. As an article is taken from the shopping cart on the in-scanner scale, the system of the invention makes an immediate determination of the decrement weight associated with such article removal. Upon scanning of the article UPC and obtaining of its weight 120 from computer store, the system compares the decrement weight with the computer-provided weight.

Should there be a discrepancy between the compared weights, it is detected by the system of the invention at the close of the scan

and prior even to movement of the article to the shopping cart on the out-scanner scale. A signal is generated upon each such discrepancy detection and the invention contemplates use of these signals to prompt store personnel intervention by way of at least the monitoring of the checkout lane involved. Preferably, the system includes a monitor unit at the checkout counter, which is activated at the close of article scan on such discrepancy signal generation. A video recording is thus made of the events following close of scan and entry of the article into the shopping cart on the out-scanner scale.

15 Since the above-discussed discrepancy may be found later not to be of fraudulent character, as is discussed in detail below, the method and system of the invention provide a feature that may be regarded as an "insurance recording" or a pre-awareness of a possibly fraudulent event, which may have manifest value in confronting the cheating customer with the evidence, should the discrepancy have been fraudulent.

20 The present invention will be described in greater detail by way of examples with reference to the accompanying drawings, wherein:-

Figure 1 is a general block diagram of one preferred form of system for the self-checkout of articles: and

Figure 2 is a detailed block diagram of an implementation of the Fig. 1. system.

Referring to Fig. 1, checkout counter 10 includes scan unit 12, which may be customary UPC scanner, and lane monitor 14, which may be a video recorder and camera. To the left side of counter 10 is a floor-installed weighing scale 16 (in-scanner scale), on which is situated shopping cart 18 containing the articles selected for purchase by a customer. To the right side of counter 10 is another floor-installed weighing scale 20 (out-scanner scale), on which is situated shopping cart 22, initially empty, but intended to receive articles seriatim from cart 18 after scanning by scan unit 12.

Scan unit 12 is connected to UPC weight store 24 by lines 26 and 28 and to controller 50 30 by lines 26 and 32. Scale 16 is connected by line 34 to controller 30. Lane monitor 14 is connected to controller 30 by lines 36 and 38. Scale 20 is connected to controller 30 by line 40. Other system connections are, UPC 55 weight store 24 by line 42 to controller 30, and controller 30 to store monitor 44 by line 46. The system of Fig. 1 is intended for use with a single lane checkout counter, but may operate with other lanes, shown tied in by phantom lines 46a and 46b with store monitor 44.

Operation of the Fig. 1 system will be better understood by considering the particular implementation of controller 30 shown in Fig. 65 2.

In Fig. 2, controller 30 is configured with input buffers 48 (in scale buffer) receiving and storing the line 34 signal, 50 (UPC weight buffer) receiving and storing the line 42 signal, 70 52 (scan buffer) receiving and storing the line 32 signal and 54 (out scale buffer) receiving and storing the line 40 signal.

It will be helpful initially to consider a proper series of activities at the checkout counter, 75 i.e., wherein a customer removes articles individually from in cart 18, scans the code thereof, and places same in the out cart 22, all before removing another article from cart 18. The initial output of scale 16, prior to first 80 article removal from cart 18 is in buffer 48 and is applied to line 56 and hence to multiplexer 58. Since line 60 is stable, not undergoing change, counter 62 is at zero count and so informs multiplexer 58 over line 64a. The 85 multiplexer is accordingly operative to furnish buffer 48 content to store 66 over line 68. Upon removal of an article from cart 18, line 34 changes its voltage reading based on the change in the output of scale 16. Line 56 90 applies the output of the in scale buffer 48, indicative of the initial cart 18 weight decremented by the weight of the removed article to multiplexer 58 and also over line 60 to counter 62. The counter, based on the change 95 in the line 56 signal, advances to first count, which is provided over line 64b to multiplexer 58. The signal output of buffer 48 is thereupon applied selectively to store 70 over multiplexer output line 72.

100 The contents of stores 66 and 70 are applied by lines 74 and 76 to subtraction circuit 78. First count indication is applied over line 80 to circuit 78, whereupon a signal indicative of the difference in weight contents of 105 stores 66 and 70 is applied to line 82 and thereby to comparator 84, a second input to which is provided over line 86 from UPC weight buffer 50. Upon scanning and suitable delay to permit line 86 data in stable form, 110 line 88 is activated to cause comparator to make the comparison of its inputs from lines 82 and 86. If this comparison is positive, indicating a correspondence of the weight indications of the two input signals, counter 62 is 115 reset to zero by signal from comparator 84 over line 90. Comparator output line 46 is not activated, since checkout events comport with those desired by the system.

In the event that the customer were to have 120 removed not one but two articles simultaneously from cart 16, comparator 84 would then find non-correspondence as between its input signals on lines 82 and 86, the former exceeding the latter, and would activate line 46, 125 either to alert store personnel, or to activate monitor 14, or both. Such line 46 signal can also be used to reset counter 62 to zero.

Likewise, in the event that the customer removes a second article from cart 18 prior to 130 validation of the first article transaction by

comparator 84, counter 62 will be stepped to its second count, based on the accompanying disturbance of lines 34, 56 and 60. Counter 62 provides output on line 92 indicative of its 5 having reached second count and such line 92 signal is used alternatively to the line 46 signal to alert store personnel or to activate monitor 14, or both.

The second level comparison, as between 10 scale 16 and UPC weight, on the one hand, and scale 20, on the other hand, may also be implemented in controller 30. Here, as the individual removed article is transferred, after scanning, to cart 22, a change occurs on line 15 40 and also at the output line 94 of buffer 54. Line 96 conveys the weight reading of buffer 54 to comparator 98 and line 100 conveys the change indication to comparator 98, which accordingly compares the lines 96 reading to the sum of the contents of buffer 48 (in scale) and buffer 50 (UPC weight), as provided on line 102 from adding circuit 104, inputs to which are furnished by lines 106 and 108.

20 25 Where the comparison effected in comparator 98 is not positive, the comparator activates its output line 110 and hence alarm unit 112.

Various changes to the embodiments particularly described and shown and modifications 30 to the practice disclosed may be introduced without departing from the scope of the invention as defined in the claims.

35 CLAIMS

1. A system for the checkout of articles bearing sensible code indicative thereof and selected for purchase, including:
  - (a) means for containing said articles selected for purchase and permitting withdrawal thereof for processing;
  - (b) first scale means for measuring the weight of articles resident in said containing means and providing an output signal indicative of such measured weight;
  - (c) scanner means for sensing such article code and generating an output signal indicative thereof;
  - (d) storage means for storing article weight information in correlation with article code and responsive to said scanning means output signal for providing an output signal indicative of such stored article weight;
  - (e) means for receipt and containment of articles following such scanning of said codes thereof;
  - (f) second scale means for measuring the weight of articles resident in said receiving and providing an output signal indicative of such measured weight;
  - (g) controller means for comparing said output signals of said first scale means and said storage means and generating a first output signal on failure of such comparison, and for 55 60 65 comparing said output signals of said first

scale means, said storage means and said second scale means a second output signal on failure of such comparison;

- (h) recorder means for recording events at 70 said checkout counter upon occurrence of said first output signal; and
- (i) means for generating an output alarm signal upon occurrence of said second output signal.

75 80 85 90 95 100 105 110 2. A system according to claim 1, wherein said containing and receiving means comprise respective first and second shopping carts and wherein said means (b) first and second scale means comprise respective first and second scales upon which said shopping carts can be separately situated.

3. A system according to claim 1 or 2, including a checkout counter supporting said scanning means and said recorder means theron.

4. A system according to claim 3, wherein said first and second scales are situated in a floor oppositely aside said checkout counter.

5. A system according to any one of the preceding claims, wherein said recorder means comprises a video recorder.

6. A system according to any one of the preceding claims, wherein said controller means comprises a counter monitoring said output signals of said first means and stepped upon change therein, plural storage units, a multiplexer responsive to said counter to gate said first scale means output signals selectively to said plural storage units, signal subtraction circuitry connected to said storage storage units and responsive to said counter to provide an output signal indicative of such subtraction, and a comparator receiving such subtraction circuitry output signal and said output signal of said storage means and providing said controller second output signal.

7. A system according to claim 8, wherein said counter is operative further for itself initiating operation of said recorder means.

8. A system for the checkout of articles bearing sensible code indicative thereof and selected for purchase, constructed substantially as herein described with reference to and as illustrated in the accompanying drawings.

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